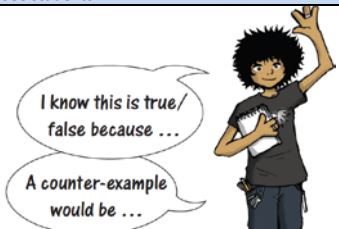







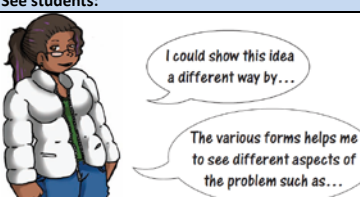





# Assessment for and as Learning with Mathematical Processes



Reasoning and Proving			
See students:	Learning Goal and Success Criteria	Sample Questions	Sample Feedback
	<b>I know I am reasoning and proving when I:</b> <ul style="list-style-type: none"> <li>• hypothesize and make conjectures</li> <li>• decide how to test my hypothesis</li> <li>• test my conjecture</li> <li>• infer, justify, and conclude</li> </ul> 	<ul style="list-style-type: none"> <li>• How can we show that this is true for all cases?</li> <li>• In what cases might our conclusion not hold true?</li> <li>• How can we verify this answer?</li> <li>• Explain the reasoning behind your prediction.</li> <li>• Why does this work?</li> <li>• What do you think will happen if this pattern continues?</li> <li>• Show how you know that this statement is true.</li> <li>• Give an example of when this statement is false.</li> <li>• Explain why you do not accept the argument as proof.</li> <li>• How could we check that solution?</li> <li>• What other situations need to be considered?</li> </ul>	<ul style="list-style-type: none"> <li>• What you have presented is true for the cases you considered. Explain some cases where this situation will not be true.</li> <li>• Present your solution, showing all the steps so someone else will understand your thinking.</li> <li>• Your reasoning was good to this point in your argument. Study your next point to see if you can identify the flaw in reasoning.</li> <li>• Identify the flaw in this argument. How would you correct it?</li> <li>• How does this reasoning follow from what you said?</li> <li>• Before you implied...and now you are saying....How can both be true?</li> </ul>
Reflecting			
See students:	Learning Goal and Success Criteria	Sample Questions	Sample Feedback
	<b>I know I am reflecting when I:</b> <ul style="list-style-type: none"> <li>• think about reasonableness</li> <li>• consider the implications of data collected</li> <li>• self-monitor my progress</li> </ul> 	<ul style="list-style-type: none"> <li>• Have you thought about...?</li> <li>• What do you notice about...?</li> <li>• What patterns do you see?</li> <li>• Does this problem/answer make sense to you?</li> <li>• How does this compare to...?</li> <li>• What could you start with to help you explore the possibilities?</li> <li>• How can you verify this answer?</li> <li>• What evidence of your thinking can you share?</li> <li>• Is this a reasonable answer, given that...?</li> </ul>	<ul style="list-style-type: none"> <li>• Explain how the data you collected to inform your thinking connects to the problem.</li> <li>• I can follow your thinking up to here. How can you help me understand your next ideas?</li> <li>• Share your explanation with this group and consider their feedback as you revise your work.</li> <li>• How does this all make sense together?</li> <li>• What solution could be more suitable?</li> <li>• How is this result applicable to the problem?</li> </ul>
Selecting Tools and Computational Strategies			
See students:	Learning Goal and Success Criteria	Sample Questions	Sample Feedback
	<b>I know I am selecting tools and computational strategies when I:</b> <ul style="list-style-type: none"> <li>• use manipulatives and/or technology to understand new concepts, to communicate, or to perform tasks</li> <li>• consider the question before I choose my computational strategy</li> </ul> 	<ul style="list-style-type: none"> <li>• How did the learning tool you chose contribute to your understanding/solving of the problem? assist in your communication?</li> <li>• In what ways would [name a tool] assist in your investigation/solving of this problem?</li> <li>• What other tools did you consider using? Explain why you chose not to use them.</li> <li>• Think of a different way to do the calculation that may be more efficient.</li> <li>• What estimation strategy did you use? Was your result sufficiently accurate for the question?</li> </ul>	<ul style="list-style-type: none"> <li>• You have selected an appropriate tool but an error has occurred. Review your procedure to identify the error.</li> <li>• Share your solution with someone who has used a different tool, and discuss the merits of each.</li> <li>• Use [name a tool] and see how it helps you solve the problem</li> <li>• Please model the computational strategy you used for a classmate.</li> <li>• Please think aloud while you apply the strategy so I can learn why you are getting this answer.</li> <li>• Try another computational strategy and see if your result is the same.</li> </ul>
Connecting			
See students:	Learning Goal and Success Criteria	Sample Questions	Sample Feedback
	<b>I know I am connecting when I:</b> <ul style="list-style-type: none"> <li>• see how new concepts and skills build on old ones</li> <li>• apply mathematics to solve problems inside and outside of mathematics class</li> </ul> 	<ul style="list-style-type: none"> <li>• What other math have you studied that has some of the same principles, properties, or procedures as this?</li> <li>• How do these different representations connect to one another?</li> <li>• When could this mathematical concept or procedure be used in daily life?</li> <li>• What connection do you see between a problem you did previously and today's problem?</li> </ul>	<ul style="list-style-type: none"> <li>• How can you relate your understanding of...to this problem?</li> <li>• How does your representation (e.g., diagram, sketch, manipulative) connect to..., e.g., the algebraic solution?</li> <li>• Please describe the connections you see between ...and....</li> <li>• How does this method relate to this problem?</li> <li>• How is that thinking connected to the question?</li> </ul>
Representing			
See students:	Learning Goal and Success Criteria	Sample Questions	Sample Feedback
	<b>I know I am representing when I:</b> <ul style="list-style-type: none"> <li>• mathematize a situation using concrete materials, pictures, diagrams, graphs, tables, numbers, words or symbols</li> </ul> 	<ul style="list-style-type: none"> <li>• What would other representations of this problem demonstrate?</li> <li>• Explain why you chose this representation.</li> <li>• How could you represent this idea algebraically? graphically?</li> <li>• Does this graphical representation of the data bias the viewer? Explain.</li> <li>• What properties would you have to use to construct a dynamic representation of this situation?</li> <li>• In what way would a scale model help you solve this problem?</li> </ul>	<ul style="list-style-type: none"> <li>• Show how you can represent this situation more efficiently.</li> <li>• How can your representation of the data include your outliers?</li> <li>• In what other way(s) can you represent this problem?</li> </ul>

# Key Features of Effective Mathematics Instruction



## 1. Encouraging Students

### Sample Indicators:

- ☐ Students share personal strategies
- ☐ Feedback is provided on personal strategies
- ☐ Students build on other students' thinking
- ☐ Communication strategies are specifically modelled
- ☐ Students are comfortable asking questions
- ☐ Students are often asked to explain their thinking

### Questions you might ask:

1. How are you getting students to listen to each other's strategies?
2. How are you getting students to share their thinking?
3. How are you handling situations where the student suggests ideas that are not clear to you when they are first offered?

## 2. Ongoing Assessment for Learning

### Sample Indicators:

- ☐ Instructional plans are sometimes changed based on prior assessment
- ☐ Instructional plans may be changed based on comments students make
- ☐ Questions are posed that evoke student thinking
- ☐ Differentiated instruction is used
- ☐ Assessment for learning information is recorded

### Questions you might ask:

1. How are you gathering data on your students' prior knowledge
2. How are you using that data to change your instructional plans for individual students (or groups)?

## 3. Building Meaningful Success

### Sample Indicators:

- ☐ All students are provided with appropriate problem solving activities
- ☐ Students who struggle work on important but accessible mathematics
- ☐ Students' confidence is enhanced by teacher's attitude
- ☐ Learners whose ideas are not clear enough right away receive continued support

### Questions you might ask:

1. How are you providing opportunities for all students to be successful in your math classroom?
2. How are you showing your confidence in all your students?

## 4. Utilize Many Approaches

### Sample Indicators:

- ☐ Open or parallel questions are often asked
- ☐ Students are encouraged to self-scaffold and teacher scaffolds by leading rather than telling students
- ☐ Alternative methods are regularly offered when students struggle with a taught one

### Questions you might ask:

1. How often are you focusing on the same big idea at different levels?
2. How do you make sure all your students are asked meaningful, higher level questions?
3. How are you teaching your students to self-scaffold?
4. Do you show an alternate method when students struggle?